

Perspectives to address artificial intelligence in journalism teaching. A review of research and teaching experiences

Perspectivas para abordar la inteligencia artificial en la enseñanza de periodismo. Una revisión de experiencias investigadoras y docentes

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RESUMEN

Introducción: En un contexto en el que los medios de comunicación utilizan cada vez más la inteligencia artificial (Neuman, 2021), y en el que esta tecnología está ausente en los planes de estudio de los grados y de los másteres de comunicación en España (Sanchez García; Calvo Barbero; Díez Gracia, 2021; Ufarte; Calvo; Murcia, 2020; Ufarte; Fieiras; Túnnez, 2020). **Metodología:** Se han localizado proyectos de investigación y experiencias docentes internacionales que abordan la inteligencia artificial y que la introducen en la enseñanza de periodismo. Además, durante el año 2021, se ha participado en seis eventos académicos nacionales e internacionales de los que se obtuvieron ideas acerca de cómo abordar la inteligencia artificial en tres ámbitos del campo de la comunicación: el ámbito investigador, el contexto profesional, y la docencia universitaria. **Resultados:** Las ideas, y las iniciativas investigadoras y docentes recogidas afrontan la inteligencia artificial fundamentalmente, desde dos perspectivas, una perspectiva crítica que atiende a las consecuencias sociales del uso de esta tecnología y una perspectiva aplicada que busca, de manera principal, formar a los estudiantes en tres competencias: la obtención y el tratamiento de datos, la creación de contenido automatizado y la verificación de contenido. **Conclusiones:** Aun siendo escasas las iniciativas investigadoras y docentes disponibles, estas aportan vías para introducir la inteligencia artificial en los planes de estudio de grado y de másteres en periodismo y en comunicación, desde una perspectiva crítica que, atendiendo a lo que realizan los medios, asuma los retos formativos derivados del uso y de la extensión de esta tecnología.

PALABRAS CLAVE: competencias; comunicación; enseñanza universitaria; innovación docente; inteligencia artificial; investigación en comunicación; periodismo.

ABSTRACT

Introduction: In a context where media are increasingly using artificial intelligence (Neuman, 2021), and where this technology is absent in bachelor's and master's degrees in communication in Spain (Sanchez García; Calvo Barbero; Díez Gracia, 2021; Ufarte; Calvo; Murcia, 2020; Ufarte; Fieiras; Túnnez, 2020). **Methodology:** We have located research projects and international teaching experiences

addressing artificial intelligence and introducing it within journalism education. In addition, during the year 2021, we have participated in six national and international academic events addressing artificial intelligence within three areas of the field of communication: research, professional context, and university teaching. **Results:** The insights, the projects, and teaching initiatives obtained approach artificial intelligence fundamentally, from two angles, a critical perspective that pays attention to the social consequences of its use in the media context and an applied perspective aiming to train journalism students fundamentally in three competences: data collection and processing, automated content creation and content verification. **Conclusions:** Being scarce, the research and teaching initiatives available, they provide ways to introduce artificial intelligence in the curriculum of the degrees and masters in journalism and communication, from a critical perspective that taking into account what the media does, assumes the formative challenges derived from the use and extension of this technology.

KEYWORDS: competencies; communication; university teaching; teaching innovation; artificial intelligence; communication research; journalism.

Translation by **Paula González** (Universidad Católica Andrés Bello, Venezuela)

Introduction

Artificial intelligence (hereinafter, AI), has expanded rapidly, since the mid-2000s, in academia and industry settings (Crawford, 2021) and refers to a collection of ideas, technologies, and techniques related to the ability of computer systems to perform tasks that normally require human intelligence (Beckett, 2019). The promiscuity of AI as a term, its openness, motivates its use to refer to devices like Amazon, or processing systems (Crawford, 2021:19). They are systems that show intelligent behavior since they analyze their environment and carry out actions, with a certain degree of autonomy, such as helping with repetitive or dangerous tasks, finding patterns in large amounts of data, or predicting climate change (European Commission, 2020). Within AI, subfields such as machine learning, which allows algorithms to autonomously identify patterns to make predictions, or natural language processing, which creates apps that produce texts in natural language (Vicente et al., 2017) are being developed. Being in continuous development, a technology that is considered AI at a certain moment, may not be considered so later on (Gunkel, 2020).

Currently, initiatives from public institutions such as the European Commission and Universities coexist to introduce AI in different areas, with the narratives of the companies that develop it (Bory, 2019) and with the existence of a “lobby”, especially in the United Kingdom, which can generate ineffective political responses to address the implications of ADM systems (“Automated decision-making systems”) on human rights (Chiusi, 2020). In this sense, by deriving AI from the operation of technologies and human contribution (Natale, 2020), algorithms can be used for purposes aimed at the common good, such as the one created by Bernstein to locate signs of labor exploitation in industrial supply chains, or they can be used for destructive purposes (O’Neill, 2016).

Reports such as those carried out by Journalism AI, a research laboratory on journalism and AI of “The London School of Economics and Political Science”, reveal the importance that this technology has acquired in the journalistic sector, generating the so-called “computational journalism”, characterized by automating the generation of information (Coddington, 2015). In this journalistic field, the use of AI is expected to modify the work structures, news flow, the relationship with users, and the tasks related to collecting, producing, and distributing content, promoting the use of augmented reality, drones, voice recognition, and “wearables” (Beckett, 2019) and modifying epistemic standards due to the influence that available technology has on the responsibilities of the subjects (Golder, Reich, and Miller, 2020).

In a context in which the media demands the need to train in the use of AI (Beckett, 2019) and, in which this technology is absent in the curricula of communication bachelor’s and master’s degrees in Spain (Sanchez García; Calvo Barbero; Diez Gracia, 2021; Ufarte; Calvo; Murcia, 2020; Ufarte; Fieiras; Túnnez, 2020), to contribute to defining ways to introduce AI in journalism training in Spain, international research and educational practices that address this technology have been identified.

In the first place, it has been considered appropriate to situate the relationship of AI with the practice of journalism.

1. Artificial intelligence and journalism: applications, changes, and challenges

Journalism is one of the activities that are being most affected by the introduction and extension of the use of AI technologies in a context in which journalism has undergone a quantitative turn (Coddington, 2015) and in which it uses algorithms to collect and analyze information (Zamith, 2019), to classify and group data, and news feeds that are personalized according to user behavior (McAdams, 2019). There is talk of computational, algorithmic, robot-journalism, or augmented journalism (Marconi, 2020), which requires skills such as arithmetic, the ability to precisely working with numbers, and the understanding of basic concepts of descriptive statistics (McAdams, 2019) and that it is necessary to differentiate from other activities in which data is used since journalism is oriented towards the creation, verification, and communication of knowledge from normative values such as honesty, research, and fairness (Lewis, 2019).

Algorithmic journalism is a semi-automatic natural language generation (NLG) process through which data is selected from databases, often public¹, from which informative texts with a predictable structure are generated. These NLG systems are attractive to companies because, besides being cheaper than hiring journalists, they allow news to be generated in various languages and reach a broader audience and new markets (Köör, 2015). In this sense, Narrativa creates eighteen thousand articles weekly about different soccer leagues that are published by news portals such as MSN or *El Confidencial* (Marconi, 2020).

AI makes it possible to discover, present, add, monetize and classify stories, detect topics, analyze videos, personalize or add and display content (Cohen et al., 2011), access more data, analyze it, obtain trends, automate actions such as changing the format from text to video, get to know readers better, or optimize content distribution (Marconi, 2020; Neuman, 2021). Journalistic companies, and especially small ones, which have more difficulty using AI (Goleatz, Bear, and Katzenbach, 2018), are interested in this technology to make work more efficient, to offer more relevant content, and to improve efficiency being the generation and labeling of content, and the creation of recommendation² and personalization tools, the functions that they are most interested in developing (Beckett, 2019).

Algorithms mediate the consumption of media content, interactions, and social relations, reviewing conversations in the online environment, which works as an ecosystem (Nápoli, 2014), and introduce changes in journalistic activity on at least three levels referring to the conception of the audience, the role of journalists in the production of texts, and their substitution in carrying out activities. At a first level, algorithmic journalism addresses the audience as automated, quantifiable, and easy to know through “big data” (Anderson, 2013), and it is also impossible to determine what criteria are used³ to group people (Gandi, 2021). At a second level, the use of AI motivates a more indirect role for journalists in the production of texts, by automating the tasks of source selection, content review, writing, and distribution (Köör, 2015), algorithms functioning as a type of “gatekeeper” (Walles, 2018, in Zamith, 2019). At a third level, the algorithms carry out activities that journalists used to do (Clerwall, 2014; Van Dalen, 2012; Westlund, 2011, 2013, in Westlund and Seth, 2017) such as subtitling videos or classifying photographs, activities now carried out by algorithms based on facial recognition patterns that have replaced workers in media groups such as Atresmedia (López de Quintana, 2021).

Recognizing that there are fundamental tasks in journalism such as listening, responding, pressuring, negotiating with sources, that AI is incapable of performing, it is proposed that this technology can

¹ Natural language generation (NLG) is used to produce information about topics such as the weather, traffic information, finances, or sports but when the domain of knowledge is expanded, it deals with the ambiguity of words and phrases (Köör, 2015).

² The New York Times uses algorithms for recommendation such as the “contextual multi-armed bandits”, which learns how people interact with content to recommend articles to them. These algorithms can use additional information about users such as their geographical location or their reading history to better estimate which articles may be of interest to them (See Cohenen, 2019).

³ While public databases like ImageNet, UTKFace, and DiF provide insight into user categorizations, the ranking engines used by tech companies like Facebook, Google, TikTok, and Baidu receive little oversight about how they categorize users and offer no avenues for a public challenge (Crawford: 2021: 150).

make human work more efficient and have higher quality, by freeing journalists of some tasks (Brousard, 2014; Diakopoulos, 2019).

As financial resources, knowledge, cultural resistance, fear of losing jobs⁴, resistance to change habits, hostility towards new technologies, and lack of knowledge in strategic management are the challenges of the media for the adoption of AI, literacy and training are identified as challenges, specifically in six areas: 1. Understanding of AI applied to journalism; 2. Basic skills such as coding data and generating models; 3. Advanced AI skills to foster innovation; 4. Uses of AI for management; 5. Ethics to understand how to reduce algorithmic bias and improve reliability, and 6. General information about AI for a better scientific and social understanding of this technology and its impact on society (Beckett, 2019).

Although there are works that provide perspectives of professionals, university professors, and students about the possibilities of AI for journalism (Calvo and Ufarte, 2020; Murcia; Ufarte, 2019), there are no works that collect research and teaching initiatives that address AI. This work aims to contribute to filling that gap.

2. Objectives

The objective of this work has been to identify perspectives and experiences to obtain ways to introduce AI in communication studies, specifically in journalism training. In line with other works that collect innovative teaching experiences in journalism (García Galera; Martínez Nicolás; Del Hoyo Hurtado, 2021; Marinho; Sánchez García, 2021; Martínez Nicolás, 2016; Solkin, 2020), teaching experiences have been identified that, in this case, introduce AI in journalism training. Furthermore, agreeing with Nahon (2021) on the importance of academic research to define how to address AI in university education, research initiatives focused on this technology and related to the field of communication have been identified.

3. Methodology

The fieldwork was carried out from March to October 2021. A systematic and integrative literature review (Torraco, 2005) of the available bibliography was carried out, a type of review also called meta-narrative (Xiau, Watson, 2019), through which the literature on a topic is identified, reviewed, and synthesized, generating frameworks and perspectives, going the synthesis activity beyond a data dump and producing an informed model or conceptual framework.

In the first place, academic papers were searched in which teaching experiences related to AI in journalism education were shared. The searches were carried out in the WOS, SCOPUS, ERIC databases, and in the Google Scholar search engine, using search strings such as “artificial intelligence and journalism education”, “automated journalism and education”, “data journalism and education”, “journalism and education”, “robot journalism and education”.

Given the scarcity of academic papers in which educational experiences that introduce AI in journalism education are shared, and agreeing with Nahon (2021) on the importance of academic research to define how to address AI in university education, a search was made for research projects focused on the relationship between AI and communication using the Google search engine.

Furthermore, given the novelty of the addressed topic, and seeking to find more perspectives on it to

⁴ Regarding the unemployment that AI can cause in the professional field of journalism, on June 11th, 2020, in the European Parliament, a journalist stated that with the introduction of AI, in the multimedia news agency of the United Kingdom and Ireland, PA Media, journalists were fired and asked to what extent the European Commission is prepared for the changes that AI introduces in the context of journalistic activity, if it has any plans to guarantee a sustainable combination of AI and human capacities. The European Commission responded that they are aware of the transformations introduced by AI to automate content production and that the implications of these transformations on media pluralism must be evaluated, and it was added that the European Commission is supporting the industry for digitalization, but for the time being, they do not aim to address labor and employment-related issues. See https://www.europarl.europa.eu/doceo/document/E-9-2020-003505_EN.html

focus on it from the academic world and introduce it in communication training and, specifically, in journalism training, six national and international academic events were attended in 2021 that discussed the use of AI in the professional, research, and educational sectors of the field of communication:

1. Webinar “Artificial Intelligence influence on PR: concepts, design, measurement”, organized by the “International Public Relations Association” (IPRA).
2. “Histories of AI: Imaginaries and Materialities”, organized by the “Digital Labour Research Lab”, of the Universidad do Vale do Rio dos Sinos and the University of Cambridge.
3. XXII Seminar on Information Management SEDIC: “Algoritmo & Compás: El profesional de la información al son de la inteligencia artificial ¿o no?”, organized by the Spanish Society for Scientific Documentation and Information (SEDIC by its acronym in Spanish).
4. Conference given by Oscar H. Gandi, professor emeritus at the Annenberg School: “Algorithmic manipulation. How shall we respond to the threats and challenges before us”, organized by the “Oregon Humanities Center”, of the University of Oregon.
5. Journalism & Communication Education 6th annual conference on Rethinking digital native communicators training, organized by the “European Communication Research and Education Association” (ECREA).
6. Congress “Artificial Intelligence and Future of Journalism. Will Artificial Intelligence take the hand of the fourth State?” organized by the Portuguese presidency of the Council of the European Union, Culture, education, and youth, Research, and innovation.

4. Results

In a context in which there are more and more online educational initiatives promoted by universities, aimed at introducing the meaning and possible applications of AI⁵, teaching experiences have been found that integrate this technology in the teaching of journalism and research projects that address the relationship between this technology and communication. Based on the review carried out, a typology of research initiatives and teaching experiences in journalism focused on AI is proposed, which differentiates initiatives and experiences raised from a critical perspective and initiatives and experiences raised from an applied perspective⁶. Research projects and teaching experiences that arise from a critical perspective address the social consequences of AI and research projects and teaching experiences that are carried out from an applied perspective focus on training students in the use of AI in journalistic activity, fundamentally in three skills: data processing, content automation, and content verification.

4.1. Critical perspective

Research projects and teaching experiences that approach AI from a critical perspective focus, fundamentally, on analyzing the social consequences of the use of AI, knowing the social imaginaries about this technology, generating vocabulary that allows contributing to the construction of an AI that is more sensitive and more attentive to the needs of society, and also in disseminating knowledge about this technology.

4.1.1. Research projects

There are different research projects that approach AI from a critical perspective. “Platform Media: Algorithms, Accountability, and Media Design”, from the University of Queensland, develops methods and tools to examine and evaluate algorithms, explore the responsibility of media platforms, compare how platforms are developing in Australia, China, and India, and re-imagine media outlets and their

⁵ The University of Helsinki created “Elements of AI” (<https://www.elementsofai.com/>) to demystify AI and to educate about this technology. In a similar vein, the platform “Digital Citizenship + Resource Platform” (<https://dcrp.berkman.harvard.edu/search/node/artificial%20intelligence>) from the Berkman Klein Center for Internet & Society at Harvard University, hosts educational resources about AI.

⁶ Lazarsfeld (1941) differentiated between managed research and critical research. Managed research solves small problems, usually of a business nature, and critical research evaluates the role of the media in society, developing a theory about prevailing social trends, using ideas related to basic human values from which the effects of the media are evaluated.

audiences in a context where platforms are dominant media.

“The hidden labor of Brazilian women on AI platforms”, by Digilabour, Universidad do Vale do Rio dos Sinos, analyzes the work of Brazilian women on AI platforms, considering the intersections between gender, the Global South, and social class. Based on the fact that there are inequalities among platform workers, through interviews with Brazilian women who work for platforms, this project seeks to find out what the working conditions are like and what the imaginaries are related to AI and work.

In the interdisciplinary research center “The ARC Centre of Excellence for Automated Decision-Making and Society (ADM+S)”, funded by the Australian government, they seek to create knowledge and literacy about automated decision-making (ADM)⁷ responsibly and ethically, formulate responsible ADM policies and practices, and train researchers and practitioners in this field.

The AI Now Institute at New York University aims to produce interdisciplinary research and public engagement to ensure that AI systems are accountable to the communities and contexts in which they are used.

The research group “Algorithmic Fairness and Opacity Group” at the University of Berkeley conducts four projects that approach AI from a critical perspective.

“Algorithmic Fairness in Mediated Markets”, collects meanings of “equity” for different social groups and explores the obligations of platforms as custodians of information about the market and as arbiters that define its structure, seeking to contribute to the development of the public debate on a “fair” algorithmic regime.

“An Alternate Lexicon for AI” analyzes the representation of social/ethical concerns about this technology, at major AI conferences, to develop a draft of the “Global and Critical AI” syllabus, generate vocabulary about AI, identify the dominant techno-imaginaries about this technology and its social impact, as well as critically and tactically expanding this field, integrating realities beyond those generated by Silicon Valley.

“Algorithmic Intermediation and Workplace Surveillance – Emerging Threats to the Democracy of Work” investigates workplace surveillance technologies and their effects on workers, to provide potential policy responses to these issues.

“Unpacking the Black Box of Machine Learning Processes”, from the perspective of “responsive design”, identifies and analyzes public conceptions and machine learning processes to intervene in their definition and the adjustment of their models.

4.1.2. Teaching experiences

Gordon and Lule (2019), from Lehigh University, in the course Media & Society, introduce journalism students to AI so that they understand the importance of studying this technology in the same way that they study television and the role of digital media. Gordon and Lule provide students with examples of AI-powered media like Google, Amazon, or Netflix, examples of voice assistants like Pandora, and examples of music services like Spotify. In their course, these instructors provide students with a working definition of AI, a brief history of its evolution, an overview of the types of AI, and some of the ethical challenges this technology presents. With this general description, teachers seek to motivate students to be curious about knowing more about AI (Friedman, 2019).

Dupagne (2019) proposes to introduce the study of AI in journalism departments through a course that reviews the strengths, weaknesses, ethical aspects, and applications of AI in communication. The aim

⁷ Automated Decision Making (ADM) systems are applied in different fields such as social media management or traffic management, and use software, rules, protocols, and devices that identify, acquire, collect, manage, and process data, making choices and predictions that can have far-reaching consequences. For example, this technology can post anti-vaccination or pro-vaccination information on Facebook.

is to provide students with an introduction to the relationship between AI and the media and, specifically, the relationship between AI and journalism, for which the researcher recommends using the books by Broussard and Diakopoulos, as well as *How Smart Machines Think* (2018), by Gerrish, a work that deals with case studies of interest to students such as how the Netflix recommendation system works.

Also from a critical perspective, Sandvigm (2016), teaches the course “Algorithmic Culture”, whose main learning method consists of asking questions about the relationship between algorithms and culture, so that students understand both domains, adopt an informed position about the intellectual debates generated by the appearance and use of this technology, and establish relationships between future developments of algorithmic culture with existing intellectual frameworks and ideas. As an assignment, students must write a research article addressing some of the aspects related to the appearance and use of AI technologies.

Westlund and Lewis (2017) argue that the fundamental change that the appearance and use of AI introduce for journalism teachers is that, besides learning traditional methods to access information, students have to learn to use automated processes performed by “actants” or algorithms with AI, which introduce changes in how information is generated and produced, by generating texts whose topics are based on routines and whose contents are quantifiable, such as sports results. The perspective of Westlund and Lewis (2017) is close to an applied perspective as the researchers consider that, since there is less and less need for human editing because technological actants can adapt headlines, filters, or videos for various platforms, future Journalists must learn to publish content in CMS (“Content management systems”) of various platforms. In this sense, teachers suggest that journalism teachers should guide teaching towards four objectives:

1. Teach students how online information dissemination works, from search engine optimization (SEO) to social media optimization (SMO);
2. Reconsider journalistic ideals and the norms they teach, particularly attitudes such as professional control, which limit the profession’s capacity for innovation;
3. Shift the focus from the idea of an actor who edits and processes news to a context in which students can collaborate with technological actors to produce news tailored for a wide variety of platforms, and
4. Pay more attention to the distribution of information since news companies have gone from being proprietary and analog platforms to being configured as a wide spectrum of digital destinations.

4.2. Applied perspective

Research projects and teaching experiences that address AI from an applied perspective fundamentally focus on analyzing, developing, and using AI apps for journalistic activity.

4.2.1. Research projects

As for research projects focused on applying AI in journalistic activity, “The Journalism AI Collab”, by Polis-el LSE, from the “London School- of Economics”, began in 2020 with the support of the Google news initiative to bring together news organizations and explore solutions to improve journalism using AI. In collaboration with Google news, they created a platform that hosts free online courses such as the “Hands-on Machine Learning” course, which teaches how to create programming for journalistic purposes, using Cloud AutoML or the “Introduction to Machine Learning” course, focused on machine learning. Furthermore, “The Journalism AI Collab” maintains the AJO Project website in which representatives of *La Nación*, *Schibsted*, *Kikkei (NihonKeizaiShimbun)*, *Nicematin*, *Agence France Presse (AFP)*, *La Nación Data*, *Reuters*, *Deutsche Welle*, and *Reachplc*, share experiences about how they use AI in newsrooms.

Also from an applied perspective, the “Center of Artificial Intelligence Journalism” (CAIJ) of the Department of Journalism at Charles University, in Prague, created in 2019, researches the creation and application of AI for verification, analysis, and creation of journalistic content in Czech, the main objectives of this center being to research the relationship between ethics and the practice of journalism with AI, content verification, develop an AI system capable of producing basic journalistic content in Czech, and design a methodology for the application of AI in newsrooms in the Czech Republic.

4.2.2. Teaching experiences

The teaching experiences in which, from an applied perspective, AI is introduced in journalism training are fundamentally oriented towards training students in three skills: 1. Obtaining and processing data; 2. Automated content creation, and 3. Content verification.

4.2.2.1. Collection and processing of data

The concept of AI is directly linked to that of algorithms and this is related to databases since algorithms are lifeless and meaningless machines unless they are linked to databases in which they can develop their function (Guillespie, 2014). Journalists must competently use statistics due to the emergence of “big data” since the daily work of generating news is now based on numerical calculation (Nguyen and Lugo Ocando, 2016).

In data journalism, there are four fundamental skills: 1. Search and find documents and data that allow deep research; 2. Understand data structures and how to clean and standardize data; 3. Analyze data using spreadsheets, databases, mapping, and visualization, and 4. Learn advanced statistical methods (Berret & Phillips, 2019). Therefore, teaching data journalism implies that students learn to identify and obtain relevant data, to select, clean, and choose the right data to create visual stories, with graphics and data (Sercan, 2021).

Data journalism as a subject is absent in Spanish universities (López López, 2019), and is very limited in the United States (Berret & Phillips, 2019) or Australia (Davies and Cullen, 2016). As for the technological skills taught, only eleven of the one hundred and thirteen accredited programs in “The Association for Education in Journalism and Mass Communication” (AEJMC) offer courses in emerging areas such as drones or virtual reality, with SQL, Python, and R being the most taught languages. Teaching focuses primarily on the use of spreadsheets, teaching statistical concepts, and data visualization, using Tableau or Google Fusion (Berret and Phillips, 2019). Students are taught how to use spreadsheets like Excel, data visualization tools, and analysis tools like Tableau, Piktochart, Google Fusion, Infogram, Datawrapper, Easel.ly, Gephi, Silobreaker, Venngage, and Visual.ly, text mining programs such as Leximancer, Text mining software, and TerMine, data cleaning tools such as Open Refine, Google Refine, and Data cleaning, qualitative data analysis programs such as Nvivo, map adaptation programs such as Google MyMaps, Mapbox, and Mapstory, tools to identify trends like Google trends, data scraping programs like Kimono and OutWithHub Pro, timeline and story mapping tools like KnightLab, news aggregators like News aggregator, and trend maps like Twitter aggregator (Davis and Cullen, 2016).

Some educational programs also teach geospatial analytics, which involves overlaying two or more data sets, such as education level and election results, using open-source tools like QGIS or proprietary providers like ArcGIS or Carto and using Tableau or Power BI for visual analysis (Lewis, 2019). Sercan (2021) proposes using Excel, Google Fusion Tables, Tabule, and Wordle to manage data and Google Charts, Piktochart, Tableau Public, Gephi, Timeline, Infogram, and Adobe Illustrator to generate visualizations.

To teach data journalism, Treadwell et al. (2016) developed a collaborative experience between Auckland University of Technology and New Zealand University. For students to acquire skills related to data management, the teachers designed a research project aimed at investigating the problems caused by games of chance in the poorest communities in New Zealand, specifically lotteries. The research-training project allowed students to integrate skills related to data access, cleaning, and analysis. Before working on the project, students received classes in Excel, data analysis, and visualization, and during the project, they used spreadsheets and web-based trend visualization programs such as Google Fusion Tables and Datawrapper.

Hewett (2016) sought for students to continuously self-assess their progress, so they had to write in blogs and on a collaborative website, about their evolution as data journalists, indicating how the use of data was useful to them to make their reports, and explaining how to do a critical analysis of pieces of data journalism. According to the researcher, the training module focused on students learning to find stories in the data; understand the structure and context of data; clean and analyze them, and ge-

nerate stories from them.

Kashyap and Bhaskaran (2020) suggest three lines of action to introduce data teaching:

1. Using public databases on which students can ask questions and carry out projects related to the neighborhoods and cities in which they live.
2. Doing projects based on the community and the use of various sources as a pedagogical tool so that students understand the importance of practices related to the use of relevant data, as well as the importance of the audience. In this sense, the researchers propose to collect data from marginalized communities on pressing issues such as gender violence or caste discrimination in India, to help students understand the importance of data journalism for the community, and also the challenges (privacy violations, low response rates, or the iterative nature of a multi-source project) linked to the use of these methods.
3. Teach students to code with R, Python, or JavaScript libraries and manage databases, using Ruby on Rails or MySQL.

4.2.2.2. Automated creation

In the workshop given at “The Tow Center for Digital Journalism” at Columbia Journalism School, students learned how to create text with videos, using two AI tools: Automated Insights and Wibbitz. Automated Insights allows natural language generation (NLG), that is, it transforms data into narratives for any application, making it possible to develop dynamic templates that convert structured data into articles. Using image recognition, Wibbitz creates videos. Representatives from the two tools provided students with an overview of their features and applications, answered their questions, and made suggestions for students to improve the content they had automatically generated. Despite the interest of the students in these tools whose handling they learned in a short time, some of them expressed their disagreement with the fact that they are paid tools.

Considering the advantages of using tools in university teaching to which students have access, so that they incorporate technological skills more easily (Gómez-Diago, 2014), Jones (2018), introduced his final-year journalism students in the creation of “bots”, through the Flow XO free platform. The goal was to get the students to play with the technology, to understand how it works, and to add one more skill to offer to their future employers. Jones prepared a guide that contains the steps that students had to follow on the platform to configure the account and add some of the commands and pre-established answers that the program allows to incorporate in a standard way. What the students worked on the most was the “small talk” option, which makes it possible to develop responses to a variety of possible user queries.

Liao, Wang, and Wu (2019) explain that lacking the possibility of training students with the mathematics necessary to design machine learning algorithms, they trained them in practical API (Application Programming Interface) skills necessary to use computing in the Cloud. Instructors designed an elective course called “API, ML, and AI” in which students learned basic AI taxonomy, machine learning concepts, and how to use tools such as Tableau Public, Github, Python Anywhere, Jupyter Online, Digital Ocean, and AWS and Github Student.

Körner (2019) taught a course where students worked in teams to generate a Twitterbot, had their first programming experiences, and experimented and worked with different coding programs to understand the possibilities and limitations of Twitterbots. Additionally, students addressed concepts such as “big data”, algorithm, artificial intelligence, algorithmic authority, algorithmic bias, algorithmic responsibility, algorithmic transparency, and algorithmic literacy; and wrote an individual essay about the impact of AI on the media. Upon completion of the course, students expressed interest in learning to program. In this sense, Guilmer (2016) considers that all journalists should have taken at least one Java Script course to be able to communicate with programmers and learn the basic principles of code creation. Along the same lines, Körner (2019) proposes including computational skills in the journalism curriculum to prepare students to work in the current context, and Royal (2017) emphasizes that programming skills allow students to better understand media platforms and generate more meaningful stories, using data, visualizations, or creating tools to help users. Using a little code to retrieve data, inserting it into a spreadsheet, and creating a visualization, powerful visual stories can be shared, the

researcher says. Another possibility of using data for journalism proposed by Royal (2017) is to retrieve data from websites through programming interfaces (APIs) provided by various services, including Twitter, Facebook, and Spotify.

Considering that communication research can help generate more human algorithm-based communication, Gunkel (2020) introduces his students to AI, using videos and texts that address fundamental concepts of this technology and performing exercises that allow students to develop basic computer skills, understand what algorithms are, and how they work. Students learn to write simple algorithms in JavaScript. Gunkel also teaches his students how to build a basic translation algorithm, how to program a “chatbot” to understand the basics of natural language processing (NLP), and how to write an NLG (“Natural Language Generation”) template to produce song lyrics.

From a perspective that is both applied and critical, Diakopoulos (2013) proposes to analyze the algorithms from the reverse engineering model (Gehl, 2014), a model that identifies the specifications of a system through a rigorous examination based on knowledge, observation, and deduction. The researcher and teacher stresses the need to carry out many tests to integrate teaching about AI in journalism studies but considers it important to teach students “algorithmic responsibility”, which addresses aspects such as: 1. The criteria used by the algorithm for prioritizing, classifying, and emphasizing information; 2. The data that acts as inputs to the algorithm; 3. The error rate of the algorithm; 4. The data about the training of the algorithm and its potential bias, and 5. The definitions, or thresholds, used by the algorithms.

Diakopoulos’ course, “Computational Journalism,” explores the conceptualization and application of computational approaches to the practice of journalism, in which students examine how computational techniques are changing journalistic data collection, content curation, meaning, presentation, dissemination, and content analysis. Throughout the course, students perform tasks that are discussed and applied in journalistic scenarios and that are oriented towards news automation, data mining, visual analysis, the use of platforms, and the exercise of algorithmic and ethical responsibility.

Given the complexity of the algorithms, according to Diakopoulos (2013), the role of journalists will be essential to achieve transparent information. In this sense, the professor and researcher argues that in the same way that business journalists help the public to understand the financial information of companies, journalists will be needed to frame, contextualize, and explain the information on algorithms, so that they participate in the algorithmic accountability through the use of interviews or document reviews that dig deeper into the motives and design intent behind the algorithms.

4.2.2.3. Content verification

One of AI’s lines of action is news checking, an increasingly relevant activity in an environment in which the ease of publishing content has exponentially multiplied false content.

Regarding the need to verify the news, the European Commission’s high-level expert group (HLEG), in its report (2018.a) on “fake news” underlines the importance of journalists having technological tools to address misinformation. In this sense, the European Union (2018.b) in the document “Communication on the fight against online disinformation”, expresses the need to take advantage of AI to combat disinformation.

While AI tools are being used to detect fake news, the majority of “deep-fakes”, videos showing fake images, usually of a person’s face, are generated using AI. The algorithm looks for cases where two individuals have similar expressions and then juxtaposes the two faces. Marconi and Daldrup (2010) propose three ways to detect fake videos: 1) Examine the source; 2) Find previous versions of the video, and 3) Examine the video in detail.

Luttrell, Wallace, McCollough, and Lee (2020) propose using AI tools in classes for students to verify messages because, according to the researchers, although the Millennial and Z generations grew up as digital natives, they lack a perspective about the professional applications that they have available, as well as a critical perspective that enables them to know how the platforms work.

Wardle and Derachsan (2017) in Vukić (2020) consider that the concept of “fake news” is not appropriate to illustrate the complexity of specific forms of information and propose to speak of misinformation and bad information, underlining the need to pay attention to three phases: 1) Creation; 2) Production and 3) Distribution and three elements: 1) Agent; 2) Message, and 3) Interpreter, involved in the production of information, to analyze its veracity.

Orsoz (2017) suggests introducing content about AI transversally in all subjects of journalism studies. Specifically, the researcher proposes to teach students to handle different information verification tools and to download and configure browser extensions for data verification, as well as to collaboratively reflect on the criteria used by these tools.

In this line aimed at introducing journalism students to the use of AI for content verification, Veglis; Maniou, and Panagiotou (2019), trained students in news checking through an activity that consisted of students examining the Twitter accounts of the leaders of the member states of the European Union for ten days, with the TruthNest app. Each participant was randomly assigned two political leaders and after doing the analysis, they talked with the teacher about the variables used by the tool to determine the authenticity of the content, some of which were frequency of publication, weekly activity, hashtags used, users mentioned, users retweeted, the content of tweets, websites mentioned, network size, frequency of updates, important followers, suspicious followers, retweets received, and profiles with similar names.

5. Conclusions

AI poses a challenge for university teaching in journalism on at least three levels. At a first level, there is an epistemological challenge since AI technologies function as sources and receivers of information, beyond being channels, which is the function that much of the research in the scientific field of communication grants to technology (Gunkel, 2012, 2020), being necessary that Communication Theory and research on automated journalism address the interactions between humans, between humans and machines, and between machines (Lewis, Guzman, and Schmid, 2019). Secondly, there is a theoretical and ethical challenge, which has to do with the need to contribute to (re)defining a profession that is being redefined (Deuze, 2017), and thirdly, there is a pragmatic challenge that consists of shortening the distance between what the media demands and what is taught in journalism degrees (Finberg, 2013), without fully adjusting to the demand of the media to train in practices different from those they carry out (Folkerts, Maxwell, and Lemann, 2013).

In this context, the development of AI technologies and their application in journalistic activity demands the expansion of the curriculum in communication studies, including experiences that provide students with skills related to computer programming and that improve their critical involvement with technologies from the perspectives of social sciences and humanities (Natale, 2020). In this last sense, it is proposed to place human beings at the center of the socio-technical discourse about AI (Broussard, 2019) and to promote in the educational context what only humans can do (Joler, 2021; Davis, 2020)⁸, stimulating a paradigm shift that, while maintaining the role of journalists as content producers, emphasizes their role as facilitators, as connectors (Robinson, 2013).

The academic and scientific field of communication, in its research and educational dimensions, is called to play an important role in the social sphere but it is necessary to update it. The present work has tried to contribute to this purpose, providing a review of research initiatives and educational practices that address AI and that introduce it into journalism teaching. From the collected research and teaching experiences, ways are obtained to address AI in journalism teaching and tools whose management can be taught to students.

From a critical perspective that can be anchored in the ecology of communication (Waisbord in Zamieth, 2019), cultural studies (Chambers, 2021), the history of media and communication (Bory; Natale; Trudel, 2021), or sociology of AI (Anderson, 2013), and from which aspects related to power and

⁸ Davis (2020) places the advantage of journalists over algorithms in that they can interview by asking empathetic, understanding, antagonistic questions, with irony or emotion.

justice, epistemology, labor rights, protections related to data extraction, inequality, or climate change (Crawford, 2021) are connected, it is proposed to introduce students to basic concepts related to this technology as well as the analysis of platforms.

From an applied perspective, it is proposed to teach students to process data, create content in an automated way, and verify content. Furthermore, from an applied and critical perspective, it is proposed to develop an algorithmic responsibility that ensures knowing how algorithms work (Diakopoulos, 2013). This algorithmic responsibility may be one of the activities likely to be carried out by journalists who are seeing how the algorithms are in charge of many of the tasks they were performing, journalists who can contribute to solving one of the problems pointed out by Gandy (2021) regarding the use of AI by the media and is that people do not know based on what criteria the algorithms have included them in certain groups.

Understanding journalism teaching as a fundamental tool to renew journalism (Drok, 2019), it is necessary to introduce contents that, transversally, situate the relationship between the practice of journalism and AI and contents and/or subjects that provide students with technology competencies that allow them to participate in the use, evaluation, and design of virtual environments that, with their “affordances” (Gibson, 1977), with what they allow and do not allow, condition the relationships we maintain and the societies we generate.

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